magnificent museum and laboratories of the Forestry School at Munich, the Forest of Freising, the willow nurseries and plantations at Oberberghausen, the spruce forests at Hohenaschau, and the timber depot at Traunstein. They then proceeded to the Austrian forests of the Salzkammergut; and later to the Forest School and school forests at Nancy, the cork oaks and pine forests in the Esterel, and the *Pinus maritima* forests on the west coast of France, used for the preparation of turpentine as well as for timber.

With this practical tour, the training of the young forester in Europe stops, and he departs for India to assume the new duties and large responsibilities of his life as a forest officer under the Imperial Government.

THE BALTIC AMBER COAST IN PREHISTORIC TIMES.

Die prähistorischen Denkmäler der Provinz Westpreussen und der angrenzenden Gebiete. Von Dr. A. Lissauer. (Leipzig: Engelmann, 1887.)

THE prehistoric antiquities of that part of the Baltic coast that lies about the mouth of the Vistula have something more than a local interest. The old Prussian shore—the land of the Æstii of Tacitus and Cassiodorus, of the Estas of King Alfred—had already in very early times a European importance in its connection with the widely ramifying amber commerce of antiquity, of which this was in historic times the richest field of production. The present work by Dr. Lissauer, the President and founder of the Anthropological Section of the Natural History Society of Danzig, is peculiarly welcome as giving in a thoroughly scientific form a summary of the results of the archæological discoveries made in recent years relating to the prehistoric period in the province of West Prussia and its border districts. The author has divided the work into several sections, corresponding to the Neolithic, Hallstatt, and the successive Iron Age periods, and has accompanied each with an excellent synoptic list of the various individual finds.

Of the earlier Palæolithic Age there are, of course, no remains in this Baltic tract, which was still covered with an ice-sheet at a time when primæval man had already begun to tenant the caves of Cracow. As the ice retreated there was formed the great glacier stream at present represented by the Vistula, but which then prolonged its course to the west, and, joining with the Elbe, poured its waters into the German Ocean. The physical event which in this region dominates all the succeeding history is the breaking through of the Vistula at Fordon, near Bromberg, and the formation of the new channel by which it poured itself henceforth into the Gulf of Danzig; and this, geologically speaking, was a comparatively recent consummation. The author has reproduced an elaborate calculation of Jentzsch, based on the formation of the delta and the average amount of sediment conveyed by the waters of the Vistula, according to which the breaking through of that river to the north must have taken place approximately about 3000 B.C. That the Neolithic immigration into the Old Prussian land from the south must have taken place at an early period is seen from the local distribution of these remains, which tends to show that the ice and snow still lingered on the higher parts of the country. On the other hand, from the fact that Neolithic settlements are peculiarly abundant in the old bed of the Vistula itself, Dr. Lissauer concludes that this immigration did not take place till well after the date when the river had taken its new course. Here, too, as elsewhere, we find the same entire revolution in the character of the Neolithic fauna as contrasted with the Palæolithic group of the Polish caves for example. Not a single representative remains. No reindeer bones even have been discovered on the Neolithic sites of the lands of the Lower Vistula, though the remains both of aurochs and of bison have been found.

Among the most interesting and characteristic objects that appear in association with the Neolithic deposits of the Lower Vistula are certain rude representations of human and animal figures cut out of amber. These remarkable productions, perforated as if for suspension, and engraved with fine lines, are more frequent to the east than to the west of the Vistula mouth; but one of the most striking, a figure of a boar, ranked by Virchow amongst the best relics of the plastic art that have reached us from the Stone Age, was found in the neighbourhood of Danzig. These amber men and animals have been the object of a special study by Dr. Tischler, of Königsberg, whose researches into the prehistoric remains of East Prussia are the complement to those of Dr. Lissauer in the Western Province. In his admirable papers on the Stone Age in East Prussia, Dr. Tischler has shown that these figures are characteristic of an extensive East Baltic region; they have been found in the same shapes and with the same perforations, but cut out of bone and stalagmite instead of amber, in the Polish cave of Pod-kochanka; and, what is still more remarkable, bone figures of analogous character have been discovered amidst the remains of a Neolithic station, described by the Russian explorer Inostranzeff, on the shores of the Lake of Ladoga. From these and other parallels, Dr. Tischler has been able to establish the existence of a distinct East Baltic Stone Province extending from the Oder to the Lake of Ladoga, and in all probability to the Onega shores, and including not only the provinces of East and West Prussia but the greater part of Poland. The relation of these northern "idols" to the clay figures of men and animals found in the Swiss lake-dwellings, in the pile settlements of Laibach, and some of the prehistoric sites of Hungary and Transylvania, where one has been found of alabaster; and the relation again of these latter to the "Pallas" of Dr. Schliemann's Trojan excavations, or the rude "Carian" and Cypriote figures, suggest wide and far-reaching inquiries on which it is impossible here to embark.

Of the Bronze Age, pure and simple, there are very scanty remains in these East Baltic coast-lands; though there are sufficient examples, both of Hungarian and West Baltic forms, to show that before the close of the period in Central and North-Western Europe its arts were already taking root in this region. Dr. Lissauer's remarks on what he terms the "so-called Bronze Age," but which, in the greater part of our Continent at least, represents a very well defined stage of culture, reflect an attitude of mind not yet wholly extinct amongst German scholars. How far the Hallstatt culture can in this district be regarded as the immediate successor of that of Neolithic times is a question, however, of comparatively secondary importance. The main fact with which we have to deal is that it is only in the transitional age that takes its name from the great Salzkammergut Cemetery, and when iron was already coming into use, that we have the evidence of intimate and extended relations between the Amber Coast of the Baltic and the lands to the south and south-east. The importance of this fact in its bearing on the early course of the amber trade does not seem to me to be clearly brought out by Dr. Lissauer. Montelius, however, has conclusively shown that throughout the earlier and purer Bronze Age in Central and North-Western Europe the source of the amber supply was not the East Baltic, but the coast of Jutland and the mouths of the Elbe and Weser, where, as Müllenhoff has demonstrated on purely literary grounds, lay the Amber Islands of Pytheas. The main course of this early commerce, as indicated by the connection of the Bronze Age forms discovered, was up the course of the Elbe; and the first appearance of an intrusive southern culture at the Vistula mouth in Hallstatt times shows that it was not till this comparatively recent period that the Baltic amber route was opened up. But, when once this, then probably as now, far more prolific field was known, southern commerce showed more and more a tendency to follow this route, to the final desertion of the older line to the north-west. Among the most characteristic evidences of the trade relations thus established between the Old Prussian Amber Coast and the Mediterranean may be cited the discovery of a "cordoned" bronze bucket of the class common to Northern and Southern Italy, and of which large finds have come to light in Southern Hungary,—a class of objects which there seems no longer any warrant for qualifying, as Dr. Lissauer does, as "Etruscan," but which, as Helbig has shown, may very well represent an old Chalcidian fabric. A whole succession of finds of Greek coins further mark in somewhat later times the continued intercourse with the south. Dr. Lissauer apparently accepts the much-disputed Schubin find of Archaic coins of Athens and Erchomenos, and though the inclusion in this sixth century hoard of two later pieces of Athens and Miletus, and a modern Siamese coin, render the circumstances of the find open to grave suspicion, the later series of discoveries of coins of Thasos, Macedon, &c., extending from Hungary to Gothland, throws a retrospective light on the probable direction followed by one branch of this Baltic commerce. It appears equally clear, however, both from archæological and historic sources, that another line crossed the Julian Alps to the head of the Adriatic, finding in all probability its southern continuation by the East Adriatic coasting route. This, it will be remembered, was the route followed by those who, in Herodotus's account, conveyed the mysterious gifts of the Hyperboreans to the Delian shrine of the Sun-god—a mission which seems to have an inseparable connection with the "Sun-stone" Islands of Eridanos's mouth and the Phaethontid maidens.

Among the most interesting and characteristic features of the Hallstatt period in West Prussia are the "face-urns," or cinerary vases with human features rudely modelled on their neck; and Dr. Lissauer is probably on the right track when he compares them with the early vases of the same kind discovered by Fräulein von Torma in the Valley of the Maros in Transylvania. That they have any relation with the "face-urns" of Etruria seems out of the question, especially since the appearance of the monograph of Prof. Milani, tracing the evolution of the developed Tuscan type from an earlier class of cinerary vases with funeral masks attached to them. But the parallels from the Maros Valley may be more plausibly regarded as supplying an intermediate link in space and time between the face-urns of the Baltic coast and those of prehistoric Troy. In other respects the ceramic forms that occur in West Prussia and its borderlands during this period, such as the "twin" and painted vases, show strong southern and south-eastern affinities; while the occurrence amongst the ornaments of *Cypræa moneta* and *Cypræa annulus* from the Red Sea and Indian Ocean point to still more extensive eastern relations. Cowry ornaments, it may be worth observing, are of frequent occurrence in the prehistoric cemeteries of the Caucasian region, and there is here perhaps an indication of old Pontic communications by the Dniester or Dnieper Valleys—lines of intercourse which Dr. Lissauer does not seem to have kept sufficiently in view.

The Hallstatt culture on the Old Prussian shore is in its turn cut short by that to which we in England give the name of "Late Celtic," but which on the Continent passes by the name of La Tène from the Swiss station of that name. The Roman taste for amber ornaments subsequently gave a great impulse to the commercial intercourse between south and north *viâ* the Pannonian frontier station of Carnuntum, and we have abundant evidence of the progress of Roman provincial arts on the Lower Vistula. The finds of Roman coins become more and more frequent, and culminate in the reign of Severus, after which time they as suddenly fall off. There can be little doubt, as Dr. Lissauer has suggested, that this sudden break in the commercial relations with the south is due to the great migration of the Gothic tribes, who had before this time established themselves in this part of the Baltic coast, to their new seats on the shores of the Black Sea and Trajan's Dacia. Into the depopulated lands west of the Vistula the new tide of Slavonic settlement now poured, while the older branch of the Litu-Slavic race, the Æstii or "Old Prussians," still held their own on the Amber Coast to the east of the river-mouth, as we know from the offerings made by them to King Theodoric. The last section of Dr. Lissauer's work is directed to this Wendish period of East Baltic history, to the "Burgwall" and the "Bergwall," the pile-dwellings, the characteristic pottery and ornaments of the primitive Slavonic race, and to the monuments of their rising commerce with Byzantium and the Arabian East. To a somewhat later date, perhaps, may be assigned the curious stone figures included by Dr. Lissauer in an appendix to his Neolithic section, and as to the date and origin of which he refrains from conjecture. There can, however, as the author himself admits, be no reasonable doubt that they belong to the same category of monuments as the well-known *Kamienne baby* or "stone wives" of the Russian steppes. They extend, in fact, in an unbroken zone through Poland and Lithuania to the steppes of the Dnieper and the Sea of Azoff, and find their analogies in Central Asia and in the rude stone figures on the Siberian kurgans. As to the ethnic character of the people who spread them over this vast Scythian region, we have the direct testimony of the traveller Rubruquis, who, when visiting the Polovtzi or Kumans—the scourge of mediæval Russia—actually witnessed their erection over the grave-mounds or kurgans of that race. Their Turko-Tataric origin is indeed entirely borne out by their physiognomy, which, as I have myself had occasion for observing in various parts of Southern Russia, is of an unmistakably Mongolian cast, and their dress and accoutrements thoroughly bear out this identification, the head-gear in some instances being identical with that still worn by some Tekke-Turkomans. Individual divergences of type in some of the western examples may of course show that these Mongolian images were imitated by Wendish or Old Prussian, Polish, or Lithuanian hands. Two things, however, may be regarded as certain: that the stone figures of the steppes are of Turko-Tataric origin, and that the date of their Baltic reproductions is considerably later than Neolithic times.

ARTHUR J. EVANS.

VOLTAIC ELECTRICITY.

Voltaic Electricity. By T. P. Treglohan, Head Master, St. James's Science and Art Schools, Keyham, Devonport. (London: Longmans, Green, and Co., 1888.)

ONE occasionally hears of the evil effects of cram and bad teaching which the system of examination and payment by results so extensively made use of by the Science and Art Department is supposed to encourage. If such books as the above are in general use by teachers or candidates, it cannot be denied that the evil is very serious.

There is little of reasoning or explanation anywhere; but, instead, there are strings of statements which would, if they were accurate, consist of ready-made answers for such questions as may be set for the first stage or elementary course of voltaic electricity. At the end of the book will be found the elementary questions in voltaic electricity for the last twenty years, with numbers attached showing the pages where the answers may be found.

The book professes to be largely experimental, and the student is urged to make the apparatus and to try the experiments described. A few extracts will show how utterly misleading it is in this respect.

If the tongue is placed between a penny and a half-crown, "a feeble spark is seen as contact is made between the two metals."

"The missing Zn" (owing to the action of a voltaic cell) "is found in the cell, either in the liquid or at the bottom, as a grayish-coloured deposit."

"This" (the bichromate) "was a strong cell, and was tolerably constant; but, after a short time, was weakened in consequence of crystals of chrome alum forming in the liquid. To prevent this crystallization, the liquid must be frequently disturbed, either by lifting the plates out of it, or by some other means."

After speaking of the Daniell, Bunsen, and Grove, the author describes the Leclanché as "another very constant cell."

To show that zinc and carbon have a greater E.M.F. than zinc and copper in a cell, a condenser and two electroscopes are recommended to be used. In the figure the plates are shown separated and connected each to the zinc or copper and to one electroscope, of which the leaves are widely divergent. The student is not told that the connections must not be so made, nor is any practicable method of making the experiment described.

"In brine the positive and negative elements have the same relative order as in dilute acids; but in ammonia the relation is reversed, and those that were negative in the former case will be positive in the latter."

"It is found that the wire attached to the Cu, C, or Pt has free statical electricity apparent at its terminal, which repels the glass rod rubbed with silk, and that attached to the Zn free statical electricity, which repels the sealing-wax rubbed with flannel."

This extraordinary statement appears five times in a few pages.

Three or four Grove's cells are "necessary" to electrolyze acidulated water; the hydrogen gas collected in one of the tubes of a voltameter explodes "with a tolerably loud report." When a solution of common salt is electrolyzed, "the sodium of the salt and the hydrogen of the water" (appear) "where the current leaves the cell."

"Another simple experiment is to send the current through a solution of iodide of potassium. A brown substance—iodine—is seen at the anode, and the metal potassium at the cathode."

It is doubtful what some passages mean, as for, instance, the paragraph:

"If any number of plates be used together, the E.M.F. of such a cell would be the result of the difference of potential of the two plates which are furthest apart in the electromotive series."

Frequently, the language is more than careless; thus, after speaking of sulphuric acid and sulphate of copper, the author says *other* binary compounds; and, after describing the action of a solenoid, he says coils and helices *also* exhibit magnetic properties.

Those expressions of doubtful meaning—intensity and quantity—are freely used, as is the word potential, which fortunately has not its meaning explained. The names of some of the units are met with for the first time in the sentence: "Current strength is calculated in amperes, electromotive force in volts, and resistan*ces* in ohms." Not a word of explanation is given.

NATURAL HISTORY OF VICTORIA.

Prodromus of the Zoology of Victoria. Decades 1-15. By Prof. F. McCoy. (Melbourne, 1878-87.)

JUST ten years ago, Prof. Frederick McCoy decided, under instructions from the Victorian Government of the day, to commence the publication of a series of short descriptions, accompanied by coloured figures, of the indigenous members of the different classes of the animal kingdom. These were to be published in parts containing ten plates in each, which have appeared with commendable regularity to the present time. As the fauna of Victoria was not as well known as its flora, it was a necessary preliminary, in order to effectually carry out such a scheme, to have a large number of drawings made, as opportunity arose, from the living or